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PYRETHRUM-OIL SPRAYS IN OPEN-TYPE TOBACCO WAREHOUSES

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Large stocks of flue-cured tobacco are normally held in storage for 2 to 4 years. This tobacco is attacked by two major insect pests, the tobacco moth (Ephestia elutella (Hbn.)) and the cigarette beetle (Lasioderma serricorne (F.)). Much tobacco is stored in open-type warehouses, which cannot be readily fumigated. In these warehouses the tobacco moth is the most important pest. The most common control measure has been dusting with pyrethrum powder. This treatment is fairly effective against the tobacco moth, but is of little value against the cigarette beetle. It is not so effective against the tobacco moth as is desired, and the powder leaves an objectionable deposit of spent dust.

The tobacco moth and the cigarette beetle lay eggs on or near the tobacco. The eggs hatch into tiny worms, which feed in the tobacco. Sometimes the mass of tobacco in a hogshead is damaged to a depth of 6 or 8 inches, so that serious loss results. The adult insects do not feed on tobacco. It has been estimated that the average annual damage to flue-cured tobacco in storage caused by insects amounts to \$5 per 1000 pounds. This represents a loss of \$5,000 to \$15,000 per warehouse.

The tobacco moth and the cigarette beetle pass the winter in the worm, or larval, stage. The first brood of adults appears in April, May, and June, the cigarette beetle usually 2 to 4 weeks later than the tobacco moth. The adult insects live for 1 to 2 weeks. In summer the life cycle of both species requires about 50 to 60 days, so that a second brood of adults (the main brood) appears in July or August. Sometimes a partial third brood appears in October.

The tobacco moth emerges from the tobacco to mate, but the cigarette beetle may mate in close confinement. There is a period in the beetle's life cycle when it emerges and is found in flight

^{1/} W. D. Reed (resigned June 13, 1946) supervised this work during its early stages, and the American Tobacco Company and the R. J. Reynolds Tobacco Company cooperated and gave active assistance in this project.

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in large numbers. During this flight period, or period of activity outside the tobacco containers, they are subject to control with insecticides. If insecticides can be applied systematically and frequently enough to prevent heavy egg deposition, an infestation can be controlled.

An effort to find a more effective control measure for the tobacco moth in open warehouses has led to the development of a concentrated pyrethrum-oil spray. This spray is more effective and cheaper than pyrethrum powder, and leaves no undesirable residue. Extensive tests over a 6-year period have shown that it is safe to use on cigarette tobaccos. More than 120 million pounds of flue-cured tobacco in hogsheads have been sprayed with no injurious effects. Numerous tests have shown that there is no effect upon the taste, aroma, texture, or aging of the tobacco. Various fire-insurance underwriters have approved the spray for use in tobacco warehouses if reasonable precautions are used. SPARK-PROOF MOTORS AND SWITCHES SHOULD BE USED ON POWER SPRAYERS, AND SINCE ANY OIL IS FLAMMABLE, IT IS NECESSARY TO OBSERVE THE PRECAUTIONS RECOMMENDED BY THE FIRE-INSURANCE UNDERWRITERS FOR HANDLING SUCH MATERIALS. However, it is believed that the use of pyrethrum-oil spray offers no more fire hazard than does the pyrethrum powder, which has been in general use for 10 years.

Tobacco takes up moisture readily, and excessive moisture induces molds and rots. Therefore, the diluent used in this spray was a light, highly refined, very volatile oil of the fly-spray base type. Manufacturer's specifications for this oil are as follows: Max. sp. gr. at 60°F. 0.797, flash point 175°F., colorless, and no kerosene odor. This material is so volatile that all traces vanish within a few hours after spraying.

The spray is a space spray designed to kill the insects in the air. It does not penetrate the hogshead and will not kill the young stages of insects in the tobacco. Since the insecticide can kill only those insects it hits, thorough coverage is essential. Care must be taken to see that the spray reaches all parts of the warehouse. A mobile power sprayer (1) especially designed to blow the spray over the tops of the racked hogsheads has been found to be most satisfactory for applying the spray.

A dosage of 100 ml., or approximately 3 fluid ounces, per 1000 cubic feet of air space is desirable. A lesser amount failed to give adequate coverage, and more was unneeded.

For control of the tobacco moth a spray containing 0.2 per cent of pyrethrins is recommended. It will kill all tobacco moths hit

by the spray. This spray is not strong enough to control the cigarette beetle, which is more resistant to pyrethrum. The cigarette beetle can be controlled with a spray containing 1 per cent of pyrethrins. This stronger spray, of course, is more expensive and should not be used unless necessary.

Suction light traps should be operated in all tobacco warehouses. A weekly catch in such a trap of 50 tobacco moths or cigarette beetles is considered dangerous. As soon in the spring as the tobacco moth infestation reaches that point spraying should be started. Spray should be applied weekly throughout the summer and until insect activity is stopped by cold weather. Usually 20 to 24 applications will be needed in a season. An example of control of the tobacco moth obtained by weekly applications of pyrethrum-oil spray is shown in table 1. In this experiment 24 large warehouses were used, each containing approximately 2500 hogsheads of flue-cured tobacco.

Table 1.--Tobacco moths caught in suction light traps in screened, open-type tobacco warehouses, 8 sprayed with pyrethrum-oil (0.2 per cent pyrethrins), 8 dusted with pyrethrum powder (0.8 per cent pyrethrins), and 8 untreated. Richmond, Va. 1945

Trapping period, week ending--		Sprayed	Dusted	Untreated
May	31	1252 ^{1/}	1524 ^{1/}	995 ^{1/}
June	7	122	317	1184
	14	14	169	989
	21	11	85	371
	28	7	61	305
July	5	9	21	96
	12	33	89	193
	19	7	44	202
	26	7	57	756
August	2	27	178	2556
	9	84	165	2811
	16	104	161	3025
	23	28	42	1644
	30	41	173	2287
September	6	109	456	2681
	13	19	71	1712
	20	28	148	1200
	27	7	49	512
October	4	10	12	581
	11	37	87	461
	18	48	112	256
Average weekly catch		37.6	124.9	1191.1

^{1/} Catch for the week prior to first application on May 31; figure not included in the average.

In spraying a warehouse the power sprayer should be moved along the aisle very slowly, and brought to a complete stop every 15 to 20 feet, in order to give the blower time to roll the fog of spray to the rear of the building. A minimum of 20 minutes should be used in spraying a medium-sized warehouse. If the sprayer is moved too rapidly, many insects will escape the spray. Care should be taken to direct the spray down the aisle, paying especial attention to the area around the doors, as well as over and between the racked hogsheads.

To obtain best results from spraying, it is necessary to screen the warehouse thoroughly with fine-mesh wire gauze. This gauze may be either 18 or 20 mesh (preferably 20), but the openings should be less than 0.0396 inch in width. An 18-mesh gauze made of wire 0.02 inch in diameter is satisfactory (2). In unscreened warehouses, even though all the insects are killed by spraying, reinfestation may occur within an hour.

Pyrethrum-oil may be purchased ready mixed in the desired strength--0.2 per cent of pyrethrins for use against the tobacco moth, and 1 per cent of pyrethrins against the cigarette beetle--or the warehouseman may mix his own spray. Pyrethrum concentrate may be purchased in various strengths of pyrethrins, such as 2, 10, or 20 per cent. To obtain a finished spray, it is only necessary to dilute the concentrate with a fly-spray base oil; a small amount of agitation is sufficient. It is usually a little more economical for a warehouseman to mix his own spray. However, a man with only one or two warehouses may find that the convenience of having a ready-to-use spray will offset the slight additional cost.

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